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ABSTRACT

Designed for instructors participating in a workshop on the use of the Personalized System of Instruction (PSI), this packet of materials examines the systems approach to classroom instruction, looks at the components available for PSI use in Somerset County College's Mathematics Laboratory, reviews the procedures currently in use in the Math Lab, and considers successful PSI programs and instructional problems. Following material on the rationale for and goals and objectives of the workshop, an overview is provided of systems approaches in education and the role of the instructor in PSI. Next, an outline is presented of the human, printed medium, and audio-visual components of PSI that are available in the Math Lab or are available upon request. A brief overview of PSI is followed by a more detailed outline of its five fundamental characteristics: (1) the stress is on the written word; (2) near perfection is required on each unit before the student can progress to the next unit; (3) students proceed as rapidly as they can and still maintain virtual mastery of course content material; (4) lectures and demonstrations are used as vehicles of motivation rather than sources of critical information; and (5) peer tutors, or proctors, evaluate student work immediately and supply personal tutoring, counseling, and encouragement. Comments on classroom management and the final examination are followed by a brief description of the use of PSI in the Dallas County Community Colleges. (AYC)

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Mathematics Laboratory and Personalized System of Instruction/ A Workshop Presentation

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Mathematics Laboratory and Personalized System of Instruction (PSI)

Joan P. Capps

Rationale: Students in developmental mathematics do not need an instructor the way they used to. Many are mature people who are there to sharpen skills but there are just as many who have a deficient background and realize it. Among the student body there are those who never took algebra including graduate students preparing for the Graduate Record Examination. Only a program which addresses the needs of such a diversity of backgrounds will make it possible for all to learn the subject.

Goal: As a result of participating in this workshop, you will become familiar with the Mathematics Laboratory as an example of a personalized systems approach to education which has proved effective in addressing diverse learning styles.

Objectives:

1) To sketch the systems approach to classroom instruction in order to provide a commonality of background.

2) To look at the components available for use in an instructional system focusing on Somerset County College's Mathematics Laboratory.

3) To discuss some of the unique qualities that these components possess to improve learning.

4) To provide participants with knowledge of forms and procedures presently in effect in Mathematics Laboratory.

5) To return to the concept of personalized instruction and discuss successful programs as well as instructional problems. Methods of dealing with the learning problems associated with PSI will be addressed.

Note:

Objectives 1-4 designed to acquaint participants with Math Lab procedures at Somerset County College.

Objective 5 designed to orient participants with concept of PSI with examples of successful programs. Workshop problems presented concerned with student success problems in a PSI environment.

I

A system is an array of resources designed and dedicated to achieve an objective according to some plan of action. It connotes order, unity, purpose, arrangement, and plan. Commonplace usage to help us understand systems concept is the use of terms solar system, railway system, Bell Telephone System, human system, Goren system, etc.

A systems approach to the management of a system is a way of thinking on the part of the managers that make them keenly aware of being involved in an existing system and alive to the fact that they can do much to optimize the pursuit of the objectives of the system by paying conscious attention to its potential by analyzing its functions and by entering into the decision making process in a highly aware manner using whatever modern tools are available.

Systems in Education

Systems approach does not insure success - it is an organized approach to decision making. By spelling out the stages in decision making it establishes a framework in which "best" decisions can be determined.

The teacher plays a role as a sytems designer at two levels:

1. As part of committees which design curricula by stating the objectives to be addressed by learners in his classroom system. These objectives are stated in terms of behaviors to be exhibited by learners as a result of presence in the system.

2. As part of materials-selection committees.He/she applies axioms that addresses the fact that:
   a) material selection should be chosen with both learners and objectives being considered. (To do what? For whom?)
   b) no design can be considered final. It is a dynamic thing which must include provision for monitoring of its operation and for modification of management or design to improve its functioning.

Teaching in a Personalized Instruction System

Systems thinking is merely awareness of the fact that a system (Math Lab or LRC) exists and is functioning. You as teacher are part- a managerial part- of the system. This role requires:

1. Continual attentiveness to the specific objectives of the system
2. Awareness of the wide variety of possible resources and their relation to the objectives.
3. A habit of mind that will think openly and creatively about the possible alternative pathways for pursuing objectives- a mind that is open to feedback and modification of plans to improve effectiveness. It is an awareness that decision making is a constant process that overlooks no good alternative

It is an attitude that seeks to identify problems; to obtain the data to make decisions that are called for; and to bring to the implementation of these decisions the most appropriate of available resources in strategy, media, procedure, and software.

Math Lab

II Components available for use in an Instructional System

* Available in Math Lab; ** Available on request

1.: Human component

*a. Teacher acting as
1. Manager
2. Major teaching device
a. Lecturer
b. Discussion leader or tutor with small groups or individually.
c. Evaluator

*b. Teacher Aides' (Tutors, Proctors) assigned to class on a regular basis.

*c. The learner himself/herself. Not only does he/she provide the internalized changes that are his learning but contributes to his own learning and that of others as a
1. Questioner
2. Discussant
3. Classroom (lab) manager
a. Leader in small group work
b. Tutor as partner of less-able student
c. In lab, he may
1. Select material he will use.
2. Decide which of several modes of instruction he'll use.
3. Choose the strategy or medium of instruction he/she prefers
4. Decide which non-basic objectives he will achieve or which parts of basic instruction he/she needs more work.

**d. Visiting lecturers

2. Printed Medium Components

For Teacher Use: Textbook and Accompanying Teacher's Manual
*,**Alternate Texts
*,**Background Books
*,**Pictures
*,**Diagrams and Charts
*,**Spirit Duplicate Masters (Prepared & Blank)
*,**Diagnostic Tests
*,**Achievement Tests

For Student Use: Textbook
*,**Teacher- prepared printed material (SSG)
*,**Workbooks for additional drill
*,**Alternate Texts
*,**Books about Math (Applications, Mathematicians Careers, etc.)

3. Audio/Visual Components

*a. Chalk and Chalkboards
**b. Overhead projectors and transparencies
**c. Slides
**d. Filmstrips

**e. Films
*f. Audio Tapes
*g. T.V.
*,**h. Computer, Calculators?
*,**i. Computer Software (see listing of available packages)
**j. Models, Manipulative Devices, and Games

III & IV Unique Qualities that Components Possess (Hands-on use of equipment and procedures available in Math Lab)

A. Handouts concerning procedures related to:

1. Tutors
   a. Application for job
   b. Attendance
   c. Evaluation
   d. Training Program Objectives
   e. Coop Seminars planned (Activities)
   f. Open-hour Clientele Attendance

2. Test- taking Schedule (Elem. Algebra)

3. Audio/Visual Equipment
   a. Sign In/Out Sheet for Tape-Player, Headphones, Audio Cassettes, Video Cassettes.
   b. Sign In/Out Sheet for Computer Software
   c. Contents of Video Tapes
   d. Software packages available for Computer
   e. Modu-Math tapes

4. Administrative Procedures
   a. Math Lab Classroom Usage Schedule indicating Open-Hours
   b. Tutor Assignment Schedule
   c. Tutors Employed To-Date with Phone #s
   d. Test Taking Forms (For New Math Teachers)

B. Suggestions for Improvement or Extension of Procedures, Material, in Somerset County College's Math Lab & LRC.

C. A classroom system"in the small"
Description of teaching procedure that could be used teaching a particular bit of math within the overall sequence.

Personalized System of Instruction

'Caps'ulized overview for uniformity of background.

ORIGINAL PERCEPTION

Gets its name from the fact that each student is served as an individual by another person, face-to-face and one-to-one, in spite of the fact that the class may number 100 students. It is suitable for courses from which the student is expected to acquire a well-defined body of knowledge or skill, which encompasses the majority of all college courses. The PSI teacher expects almost all of his/her students to learn the material well and is prepared to award high grades to those who do regardless of their relative standing in the class. He/she accepts the responsibility of meeting this goal within the normal limits of manpower, space, and equipment.

The PSI teacher divides his/her course into small units of work, writes a study guide for each unit to supplement the text, and recruits a corps of undergraduate helpers (originally called proctors) who are willing to participate for academic credit (originally). The teacher meets his/her class and explains how the course runs:

1. Each student works individually at his/her own pace.
2. Each student must "pass" each unit of the course before going on to the next. Passing a unit means achieving near-perfection on the unit test, not mediocrity. But, if a test is not passed, the student merely tries again on an alternative test form. He/she may, if necessary, repeat this procedure indefinitely until his/her performance is perfect. The only possible grades on a unit test are Excellent (A) or Incomplete.
3. Lectures and other live events are provided occasionally, only as an option, only for enrichment purposes, and only to students who have completed the work necessary to understand them. Thus, lectures are rewards toward which students work to gain admission.
4. Essential subject matter is presented in writing, on tape, on film, by a computer, or by any means accessible to the student when he is ready for it.
5. Each student has a proctor who evaluates his work immediately and face-to-face. The proctor supplies personal tutoring, counseling, and encouragement.

The teacher's classroom behavior does not attract attention. He/she does attend all classes. However, he/she is no longer needed as a dispenser of routine information- a function made obsolete by printed and audio/visual material- but is very much needed as a manager and overseer. He/she must respond to the unusual - to the novel insight that a proctor may not recognize, to the reappearance of a student missing for two weeks, to the special problems of a handicapped student, and to the deficiencies of his/her prepared materials. He/she must praise the good work of students and correct the bad. Without the teacher, the system will degenerate into a bureaucracy.

(The Basic Principles described in this overview were developed by F.S.Keller and J.G. Sherman who were both firmly established in learning-reinforcement theory.)

Five Fundamental Characteristics of PSI

The principle of steps of advance are NOT frames in a set of statements, but are more like the conventional homework assignment or laboratory exercises. Fred S. Keller wrote:

> "The response is not simply the completion of a prepared statement then the insertion of a word or phrase. Rather it may be thought of as the result of many such responses better described as the understanding of a principle, a formula, or a concept, or the ability to use an experimental technique." (Goodbye Teacher, 1968)

The 5 fundamental characteristics are:

1. The stress upon the written word.
   Helps the student develop strategy for accomplishing objectives in each unit.

2. Unit-Perfection Requirement.
   The number and size vary but good Rule of Thumb is: "One unit for each week of the course.. thus in the average semester there should be at least 15 units."

   A student may go ahead to new materials ONLY AFTER demonstrating mastery of what preceded. Different learning abilities are reflected in each person's learning process. The Mastery Philosophy CANNOT BE CONTROLLED by the CALENDAR or the CLOCK. A law of education that MUST be followed is that we CANNOT HOLD BOTH TIME AND QUALITY CONSTANT.

3. "Go at your own pace" feature.

   ALL INDIVIDUALIZED INSTRUCTION SYSTEMS (Programmed, CAI, PSI) allows content to be learned at different rates. Thus, student can proceed as rapidly as HE CAN and still keep his VIRTUAL MASTERY over the COURSE CONTENT MATERIAL CONSTANT.

4. The Use of Lectures and Demonstrations as Vehicles of Motivation rather than Sources of Critical Information

   Lecture is passive.. student needs to be placed in a position where he must respond, where he receives nearly immediate feedback from his efforts, where he may proceed at his own pace, where "punish" contingencies are minimal, and where his individual work is monitored at every step as he proceeds through the material. The student slogan for success in a lecture situation, according to a prominent educator Frank B. Brown, is "I came, I saw, I concurred." Thus, lecturing in the traditional sense fails on all counts.

   Lecture is used in PSI as:
   a. a reinforcing event.
   b. a pleasure.. touching on topics not essential to the actual course content but interesting and informative in its own right.
   c. a motivation to students who know in advance that to be

allowed to attend they must have reached a certain level in the course.

5. The Use of Proctors (single most important feature)

Peer tutors can communicate the subtleties of the course content to other students in a way that is readily understandable.

Frees the instructor from the highly predictable, redundant, repetitive errors and questions that preclude his dealing with the complex, personal and unique questions that only he/she is equipped to handle.

Management

a. The general classroom structure is composed of CONTINUAL PHYSICAL MOVEMENT:

1. In front of the room.. student aide positioned behind a table is signing out test materials to a constant flow of students entering the class.

2. Once receiving test the student moves to test-taking section.

3. When finished he moves to section where student proctor scores test.

4. If student has answered incorrectly on any question or indicates confusion, student proctor tutors the student on test material.

5. Proctor then marks exam and student goes back to front table to turn in completed test. There are three options at this time:
   a. Failed to master test, so student may retake another exam if minor errors.
   b. Mastered the completed test, so he may move on to the next unit exam.
   c. Failed to master test, so student decides to wait until later to take another exam. He/she elects to take advantage of a study section in the classroom or go study elsewhere.

b. Instructor is always present and in constant motion-- first to front of room to insure that all test materials are properly signed out-- then to the back of the room where he/she answers student questions arising from course material.

c. DISORGANIZED?? ON THE CONTRARY!

1. Students do not come to classroom until they are ready to show their mastery of the course content, and are free to leave when they have accomplished their own goals.

2. The effectiveness of the PSI format is insured by having a smooth operation of all the major elements of classroom testing procedure.

d. SUCCESSFUL LOGISTICS necessary to successful management of PSI course: Preparation of materials; good course personnel; supplementary activities;

e. FINAL EXAMINATION given in course ONCE. NO RETAKES, but given at different times in semester for flexibility.

Review UNIT TESTS are good for holistic learning.

Examples of Effective PSI Systems

DALLAS COUNTY COMMUNITY COLLEGE .. Mathematics Laboratory

STUDENTS ARE COUNSELED NOT REQUIRED TO TAKE DEVELOPMENTAL MATH

1. Students who enter program are given the placement test which places them in arithmetic, basic algebra, or intermediate algebra. They are given a calendar that lists homework, testing units, and schedules to complete one course. However, if one course is completed easily, the student may go on into the course. File kept on each student in the laboratory with place to record test scores, etc.

2. There are 52-60 students in each section with 2 instructors and one paid tutor. All 3 courses are taught in each section. Each student has a name tag on the board which he/she picks up as he/she comes in and puts down where he/she works.

3. Multiple modes of assistance are available.
   a. Some students work individually around tables (Teacher assistance is available)
   b. Tapes with practice examples, etc. are available as supplements as is computer-assisted instruction.
   c. If none of these work, there is a teacher in the office.
   d. Use practice exercises from teacher's manuals.
   e. Faculty did much of the recording which the students like.
   f. Computer programs were developed by instructors and student assistants for those conceptes that regularly cause problems.
   g. For the students(few) who feel the need for the lecture, common groups are gathered together at the blackboard in study room.
   h. Several counselors work with students on Test Desensitization when they are anxious about test-taking. Individual and group counseling help.
   i. Use Cognitive Mapping to identify more efficient way for students to learn
   j. Additional assistance is offerred in math lab during open-hours.

4. Student does work in text and checks homework with instructor. He/she elects when to take the test. Corrected test sheets are filed in student folders. As completed the test is graded IN FRONT OF THE STUDENT by any member of lab staff. A grade of at least 80% must be attained on the entire test. If not, students go over TEST and SUPPLEMENTAL MatERIALS with the INSTRUCTOR. Retests are given on alternate forms until 80% level is mastered.

5. To encourage better study habits, even though 100% is made on second test, 80% is highest grade recorded. (Grade given) Much is made of fact that highest score could have been made on first try.

6. A continuing record is kept on the student until non-enrollment of the student for 2 years or until completion of Intermediate Algebra. B is a passing grade. 90's is an A. Retesting record kept to show behavioral/ learning patterns.

CHANGES MADE .. REQUIRING CONSTANT DILIGENCE

1. More units per course. (What benefit?)
2. Require homework at end of each Unit. (What benefit?)
3. More personal contact with student EVERY class period. (What benefit?)
4. Care in record keeping (What benefit?)

SUCCESS OF PROGRAM

1. Completion rates over 60% of population (high-risk population).
2. Grade of I given to less than 10% of students.

Most common reasons for dropping course are taking too many hours or personal problems requiring withdrawal from school.

3. Enrollment increased although no college-level credit given
4. Change in attitud toward mathematics as measured on Aiken's Math Attitude Scale.
5. Change in student self-concept as measured on Tennessee Self-Concept Scale.
6. Developmental students doing as well as or better than the average of their classes later.
7. Students in later classes tend to ask more questions and are more persistent in getting answers.

8. Flexibility of entry serves needs of students in other curricula.

COMMENTS (Mine)

1. Most important function of instructor is to build self-confidence. Thus, if instructor is NOT SOLD on individual approach and COMMITTED to devising ways to make it succeed, PSI fails or is at least mediocre. WORKSHOP QUESTIONS TO ANSWER HONESTLY!
2. Student COMPETES WITH HIMSELF/HERSELF, not others, which I favor as being HEALTHY. The student MUST BLAME HIMSELF/HERSELF for lack of progress-- BUT HE/SHE KNOWS WHAT TO DO ABOUT IT! However, there are still MAGIC NUMBERS.. 15 wks, 50 minutes. WORKSHOP DISCUSSION.
3. Two major problems are PROCRASTINATION and STUDENT NOT BEING ABLE TO PROGRESS TO MASTERY LEVEL. Workshop exercises address strategies for overcoming these situations.

(Yours)

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